REMARKS

In the First Office Action, the Examiner rejected claims 1, 12-21, 23-27, and 32 under 35 USC §102(b) as being anticipated by Weigand (US 5,837,903). The Examiner rejected claims 2-4, 7, 8, 22, 29-31, and 35 under 35 USC §103(a) as being unpatentable over Weigand '903. The Examiner objected to claims 5, 6, 9-11, 28, 33, and 34 as being dependent upon a rejected base claim but indicated they would be allowable if appropriately rewritten.

Reconsideration and re-examination of the application as amended considering the following remarks is respectfully requested.

Rejection Under 35 USC §102(b)

The Examiner rejected claims 1, 12-21, 23-27, and 32 under 35 USC §102(b) as being anticipated by Weigand (US 5,837,903). Applicants respectfully disagree and traverse the Examiner's rejection.

The Examiner relies on US Pat. 5,837,903 to Weigand in rejecting Applicants claims stating that Weigand discloses measuring a pressure difference across a screen (18) as disclosed and claimed by Applicants. Applicants respectfully disagree. Weigand teaches use of a ceramic laminar flow element (LFE) (18) placed within the exhaust stream to create the pressure difference, not a screen as disclosed and claimed by Applicants. As described in Paragraph [0003] of Applicants' disclosure "laminar flow devices are typically too heavy for portable use on a vehicle without additional reinforcement, contribute undesirable thermal capacity to the system, and do not have the desired operating range for use as a portable on-board measuring device. Formation of condensation on the flow measuring devices, especially during cold starts, may also result in measurement errors." As described in Paragraph [0007] of Applicants' disclosure, "use of a thin screen or similar flow restriction element does not significantly increase the thermal capacity of the system and facilitates portability compared to conventional laminar flow measurement devices" such as the ceramic LFE (18) disclosed by Weigand.

The use of a screen according to Applicants' invention also reduces or eliminates condensation that may adversely impact flow measurements. As

described in Paragraph [0027] "screen 92 or other flow restriction element is preferably a circular element that extends across a cross-sectional area of tube 80 and includes a plurality of strands or wires arranged in an array with the spacing selected to reduce or eliminate formation of condensation under normal operating conditions, while providing a measurable differential pressure for exhaust flows ranging from engine idle to full throttle." Paragraph [0028] of Applicants' disclosure further describes and quantifies these advantages with reference to one embodiment where: "The relatively thin flow restriction element implemented by a screen resulted in an increase of back pressure of approximately 5.2% which is within the range of normal barometric pressure variation. In addition, formation of condensation was reduced or eliminated so that it did not adversely affect the accuracy of flow measurements."

Applicants' disclosure clearly distinguishes a screen from a conventional ceramic LFE as disclosed by Weigand, which has a considerable longitudinal dimension (with associated weight that makes it generally unsuitable for on-vehicle applications) required to create a laminar flow as known by those of ordinary skill in the art and illustrated in Fig. 1 of Weigand. As described by Applicants, the flow restricting element or screen is formed from a plurality of strands or wires arranged in an array with the spacing selected to reduce or eliminate formation of condensation under normal operating conditions, while providing a measurable differential pressure for exhaust flows ranging from engine idle to full throttle and to minimize increased back pressure. The thickness or longitudinal dimension is relatively thin and based on the screen pattern and size of the wires or strands, which is on the order of 0.035 inches in one embodiment as described in Paragraph [0027]. Furthermore, LFE (18) clearly does not extend across the cross-sectional area (substantially or otherwise) of cylindrical body 12. In contrast to the Examiner's contention, as shown in Fig. 1 of Weigand, LFE (18) is positioned in the center of cylindrical body 12 and covers only about 50-60% of the cross-sectional area. If LFE (18) extended substantially entirely across the cross-sectional area as disclosed and claimed by Applicants, the resulting back pressure would be significantly higher and likely unacceptable for many applications.

The longitudinal dimension of LFE (18) would also result in formation of condensation under various operating conditions. Weigand uses a heating element (28) to heat body 12 and LFE (18) to maintain a temperature above the dew point of the exhaust gas to prevent formation of condensation. (See Col. 2, ll. 50-55; Col. 4, ll. 19-38; Col. 7, ll. 60-66; Fig. 7, block 148). "This preheating is necessary to prevent the thermal inertia of the ceramic laminar flowmeter from condensing exhaust gas water which will plug and occlude the capillary tubes of the capillary section and result in inaccurate readings." (Col. 9, ll. 55-58) As described above, Applicants' use of a relatively thin flow restricting element, such as a screen, does not require a heater to reduce or eliminate condensation, does not significantly increase the thermal inertia or capacity of the system, and is light enough to use on-board a vehicle. In contrast, the LFE flowmeter disclosed by Weigand is used with an engine mounted on a test stand where weight, thermal inertia, and preheating of the flowmeter are apparently not considerations (Col. 7, ll. 48-59). It would clearly not be practical for a vehicular application to require heating of the flow element to 150 °C prior to starting the engine as taught by Weigand to avoid formation of condensation.

As such, with respect to claims 1, 20, 22, 23, and 32, Weigand does not disclose or suggest measuring a pressure difference upstream and downstream of a screen as disclosed and claimed by Applicants. With respect to claims 12 and 15, Weigand does not disclose or suggest a flow restricting element (or screen) extending substantially entirely across a cross-sectional area of the tube.

With respect to claim 14, the Examiner states that Weigand is deemed to disclose a screen having about six strands per inch in a generally rectangular array as disclosed and claimed. Applicants respectfully disagree. Even if the LFE disclosed by Weigand could be considered a screen, which it is not, Weigand does not suggest sizing of the open area to reduce condensation as taught by Applicants and does not disclose an LFE having about six "strands" (or cells) per inch as the Examiner contends. Rather, Weigand discloses that each parallel tube 20 of the capillary section of the LFE is square in cross section with an open internal area of 0.05 by 0.05 inches (Col. 3, ll. 38-39), significantly smaller than the open area (0.1317 inches) of the six mesh screen taught by Applicants to reduce or eliminate condensation formation while minimizing added back

pressure (See Paragraph [0028] for example). Applicants selection of a six mesh screen, or a screen with less than 10 strands per inch (Claim 21) provides advantages (acceptable backpressure while covering substantially entire cross-section, reduction or elimination of condensation, light weight) that are neither disclosed nor suggested by the LFE taught by Weigand. In contrast, Weigand teaches that LFE 18 is subject to condensation formation and requires a heating element 28 to preheat body 12 and LFE 18 before starting the engine to avoid condensation. As such, LFE 18 clearly does not have the necessary construction as taught by Applicants and claimed in claims 13, 14, and 21.

As described above, claims 1, 12-21, 23-27, and 32 include a number of features that are not disclosed by Weigand '903 and are therefore not anticipated by Weigand '903. As such, Applicants respectfully request that the rejection under 35 USC §102(b) be withdrawn.

Rejection Under 35 USC §103(a)

The Examiner rejected claims 2-4, 7, 8, 22, 29-31, and 35 under 35 USC §103(a) as being unpatentable over US 5,837,903 to Weigand. Applicants respectfully disagree and traverse the Examiner's rejection.

The Examiner notes that Weigand teaches the determination of exhaust gas flow but fails to teach determination as claimed by Applicants in claims 2-4, 7, and 8. The Examiner states that these claims are merely obvious mathematical manipulations of the pressure and temperature and are not patentably distinct over the prior art. Applicants are not claiming mere mathematical manipulations but a method for real-time determination of exhaust flow through an exhaust pipe of a vehicle with the particular mathematical manipulations developed by the present inventors providing various advantages for the claimed method which are neither disclosed nor suggested by the prior art relied upon by the Examiner. In particular, as described in Paragraphs [0037] through [0053] of Applicants' disclosure, various instrument functions are used to provide a real-time determination of exhaust flow based on a pressure difference generated by a screen or similarly thin flow restricting element. The instrument function claimed in claims 2 and 3 is an approximation that is somewhat less accurate than the other disclosed instrument functions, but easier to calibrate in the field, while

providing acceptable results as described in Paragraph [0047] and illustrated in Fig. 12 of Applicants' disclosure. Because Weigand discloses exhaust flow measurement on a test stand rather than a portable or on-board exhaust flow sensor as disclosed by Applicants, there is no teaching, suggestion, or motivation for Weigand to develop or use such an approximation for an instrument function. In contrast, Weigand discloses a complex algorithm and calibration set-up shown in Figures 3 and 4 to determine the exhaust flow rate that requires determination of the absolute viscosity and density of the exhaust, among other parameters. As such, the mathematical manipulations disclosed and claimed by Applicants for use in determining exhaust flow based on differential pressure across a screen or thin flow restricting element are believed to be patentable over the prior art.

With respect to claim 22, the Examiner states that Weigand is silent as to the make-up of LFE (18) but that it would be obvious to use stainless steel. Applicants respectfully disagree. Weigand repeatedly states that LFE 18 is a ceramic material that "provides desirable resistance to the corrosive properties of the exhaust gas and resistance to high temperatures. The high temperatures of the exhaust gas do not affect the dimensions of the ceramic capillaries because of the inherent properties of the refractory material." (Col. 4, ll. 11-17; See also Abstract, Col. 3, ll. 36-37; Col. 9, ll. 55-59; etc.). Weigand clearly does not recognize the advantages of using a stainless steel flow restricting element or screen as disclosed and claimed by Applicants, such as being light weight, having low thermal inertia/capacity, while being resistant to corrosion. Rather Weigand teaches use of a ceramic material that requires preheating "to prevent the thermal inertia of the ceramic laminar flowmeter from condensing exhaust gas water which will plug and occlude the capillary tubes of the capillary section and result in inaccurate readings" (Col. 9, ll. 55-59) even though Weigand states that cylindrical body 12 may be made of stainless steel or nickel alloys. As noted above, Weigand suggests that a ceramic material is required for the LFE so that the dimensions of the capillaries are not affected by the changing temperature of the exhaust flow.

With respect to claims 29 and 30, the Examiner states that it would be obvious to use a condensation trap as disclosed and claimed by Applicants in the system disclosed by Weigand with the motivation being that Weigand discloses

the presence of condensation will plug the capillaries. Applicants respectfully disagree. As described above, Weigand discloses a heating element 28, 118 to prevent formation of condensation, not a condensation trap. While Weigand recognizes the problem of condensation, an entirely different solution (a heating element) is disclosed. There is no teaching or suggestion in Weigand of any alternative solutions to the condensation problem absent impermissible use of Applicants' teachings. In addition, there is no teaching or suggestion of using a conical screen as a condensation trap as disclosed and claimed by Applicants.

Although the Examiner did not explicitly address claim 31, there is no teaching or suggestion in Weigand to provide a port for extracting samples of exhaust gas as disclosed and claimed by Applicants.

With respect to claim 35, the particular mathematical manipulations disclosed and claimed by Applicants provide advantages for in determining exhaust flow that are not recognized by Weigand as described above and incorporated here by reference. As such, claim 35 is believed to be patentable.

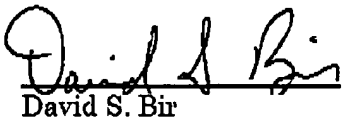
For the reasons above, Applicants respectfully submit that the rejection under 35 USC §103 is improper and should be withdrawn.

Summary

Applicants have made a genuine effort to respond to the Examiner's rejections to advance prosecution of this application. Applicants respectfully submit that all formal and substantive requirements for patentability have been met and that this case is in condition for allowance, which action is respectfully requested.

No additional fee is believed to be due. However, please apply any fees or credits incurred as a result of filing this Amendment to Deposit Account 06-1510 (Ford Global Technologies, LLC) as authorized by the original transmittal letter in this application. If there are insufficient funds in this account, please charge the fees to Deposit Account No.06-1505.

Respectfully submitted:



David S. Bir
Registration No. 38,383

December 2, 2005

Bir Law, PLC
45094 Middlebury Ct.
Canton, MI 48188

Telephone: 734-981-5646
Customer No. 46,535